# AI Planning
## Exercise Sheet 10

Date: January 16, 2015
Students: Axel Perschmann, Tarek Saier

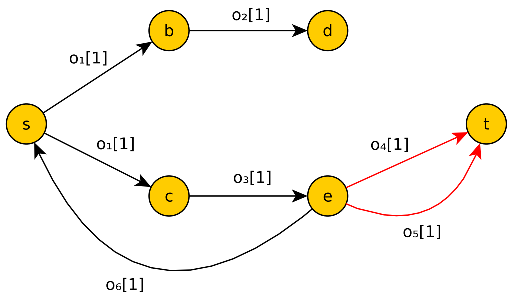
## Exercise 10.1

### Iteration i=1

| prop $p$ | s | b | c | d | e | t |
|---|---|---|---|---|---|---|
| $h^{c_i}_{max}(p)$ | 0 | 1 | 1 | 2 | 2 | 3 |

| action $o$ | $o_1$ | $o_2$ | $o_3$ | $o_4$ | $o_5$ | $o_6$ |
|---|---|---|---|---|---|---|
| pcf $D_i(o)$ | s | b | c | e | e | e |

$G_i$ :



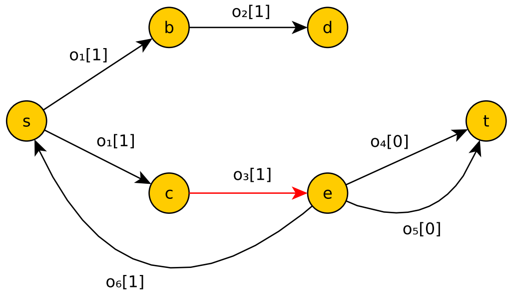

$V_i^* = \{t\}$
$V_i^0 = \{s, b, c, d, e\}$
$V_i^b = \{\}$
$L_i = \{o_4, o_5\}$
$h_{\text{LM-cut}}(I)$ so far $= 1$

### Iteration i=2

| prop $p$ | s | b | c | d | e | t |
|---|---|---|---|---|---|---|
| $h^{c_i}_{max}(p)$ | 0 | 1 | 1 | 2 | 2 | 2 |

| action $o$ | $o_1$ | $o_2$ | $o_3$ | $o_4$ | $o_5$ | $o_6$ |
|---|---|---|---|---|---|---|
| pcf $D_i(o)$ | s | b | c | e | e | e |

$G_i$ :



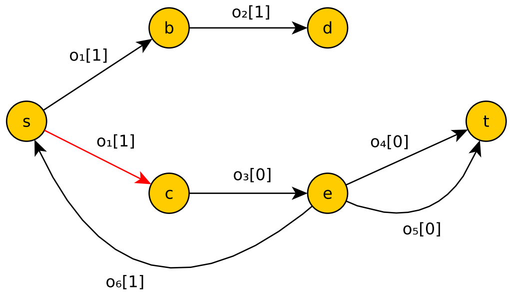

$V_i^* = \{t, e\}$
$V_i^0 = \{s, b, c, d\}$
$V_i^b = \{\}$
$L_i = \{o_3\}$
$h_{\text{LM-cut}}(I)$ so far $= 2$

**Iteration i=3**

| prop $p$ | s | b | c | d | e | t |
|---|---|---|---|---|---|---|
| $h_{max}^{c_i}(p)$ | 0 | 1 | 1 | 2 | 1 | 1 |

| action $o$ | $o_1$ | $o_2$ | $o_3$ | $o_4$ | $o_5$ | $o_6$ |
|---|---|---|---|---|---|---|
| pcf $D_i(o)$ | s | b | c | e | e | e |

$G_i$ :




$V_i^* = \{t, e, c\}$
$V_i^0 = \{s, b, d\}$
$V_i^b = \{\}$
$L_i = \{o_1\}$
$h_{\text{LM-cut}}(I)$ so far $= 3$

**Iteration i=4**

This is when $h_{max}^{c_i}(t) = 0$. The task states not to give the pcf, $G_i$, etc. for this iteration.

$h_{\text{LM-cut}}(I) = 4$

## Exercise 10.2

**(a)** The transition system for a planning task $\Pi$ shows all possible (as in reachable from $I$) combinations of variable values (nodes) connected through edges that represent operators leading from one set of variable values to another. By abstracting $\Pi$ to one variable $v$ the transition system is reduced to only represent changes in the value of $v$. Edges still represent possible transitions achieved through the application of operators. Possible values of a variable plus possible transitions is exactly what a DTG is.

**(b)**

$act\_o := \emptyset$
generate transition system for $\Pi|_v$ for every $v \in V$
for all $o \in O$:
    $act := 1$
    for all $v \in prevars(o)$:
        if there is no path from $s(v)$ to $pre(o)(v)$ in $\Pi|_v$:
            $act := 0$
        if $v$ is goal-related and there is no path from $pre(o)(v)$ to $\gamma(v)$ in $\Pi|_v$:
            $act := 0$
    for all $v \in effvars(o)$:
        if $v$ is goal-related and there is no path from $eff(o)(v)$ to $\gamma(v)$ in $\Pi|_v$:
            $act := 0$
    if $act == 1$:
        $act\_o.push(o)$